4050A

HYPOT T.M.

HIGH POTENTIAL
DIELECTRIC WITHSTAND TESTING
WITH
MODEL 4050A AC HYPOT®

ASSOCIATED RESEARCH, INC.
8221 NORTH KIMBALL AVENUE
SKOKIE, ILLINOIS 60076
U.S.A.

MANUAL 35669

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INTRODUCTION

This manual discusses the reasons why dielectric withstand tests are required, the precautions necessary to ensure that the tests are done safely, and how such tests are accomplished on various classes of materials, components and products.

In later chapters, the features of Associated Research Model 4050A Hypot® are explained, along with a step by step guide to its proper use. Finally, technical data on Model 4050A is presented.

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SAFETY PRECAUTIONS REQUIRED FOR HIGH VOLTAGE TESTING

WARNING: The Model 4050A Hypot® produces voltages and currents which can cause harmful or fatal electric shock. Respect for this is essential when handling and using the test instrument:

Plug in the high voltage test lead only when it is being used. Handle its clip only by the insulator --- never touch the clip directly. Never touch the item being tested. When you are not actively performing tests, and before leaving the test station, unplug the high voltage test lead from the Hypot®. When performing tests using the high voltage receptacle, remove and store the high voltage test lead away from the front of the Hypot®.

Connect the return (ground) lead first for any test. It should be connected to the return jack on the Hypot® and then to the exposed metal parts of the item being tested. This is true regardless of whether you are testing a sample of insulating material using electrodes, a component using the high voltage test lead, or a cord-connected device with a two or three prong plug.

When connecting a cord and plug to the high voltage receptacle, know for certain where the other end of the cord is and what it is connected to. Do not touch the cord-connected device. (The return lead should already be connected before you plug the cord into the Hypot®.)

When turning on the Hypot®, activate only the power switch. Observe the line monitor on the front panel. Its lamps should indicate that it is connected to a properly polarized and grounded receptacle (OFF-ON-ON). If not, turn off the Hypot®, disconnect it and do not use it until its power source is properly polarized and grounded.

Be certain that there are no remote test switches, over which you do not have control, connected to the Hypot®.

If you are testing an item with a three-prong plug, always use the ground continuity test to check the grounding wire of the cord and its connection to the exposed metal of the device under test.

Before pressing the push to test switch or activating a remote test switch, double check the return (ground) and high voltage connections to be certain that they are proper and secure. Never touch the item under test or anything connected to it during a test.

Perform tests on a non-conducting table or workbench, if possible. If you must use a conductive surface, be certain that it is securely grounded to a good earth ground and properly insulate the high voltage connection from the grounded surface.

WHY PERFORM DIELECTRIC WITHSTAND TESTS?

A dielectric withstand test is a deliberate application of a higher-than-normal potential across some insulating material or the entire insulation system of a component or device. This stresses the insulation and the intent is to verify that the insulation can take this stress without breaking down and allowing arcing, and without drawing excessive current. If the insulation passes the test, it is assumed that it will withstand the lesser stress of its intended application. The test can uncover defects in material or workmanship which would render the insulation system ineffective if not corrected.

The items most commonly subjected to dielectric withstand tests fall into four categories:

I. Insulating raw materials: solids, liquids, gases.

II. Components: switches, relays, transformers, circuit breakers, potentiometers, wire, cable, connectors, etc.

III. End Products: appliances, motors, instruments, office machines, the control equipment of aircraft, machine tools, etc.

IV. Repaired or rebuilt products: rewound motors, generators, transformers, repaired appliances and entertainment devices, etc.

The majority of the tests performed can be grouped into the following categories:

I. Design Tests: A manufacturer desiring to verify the insulation provided by a supplier or designed into his product may run tests in a laboratory environment. Such tests may be designed to stress insulation or insulation systems against either the supplier's or the manufacturer's own specifications, or during component selection to gauge the relative insulation quality of competing products.

II. Routine Production tests: A manufacturer may conduct tests at various points in the production of his products to uncover defects in material or workmanship and prevent the defective product from receiving further processing. Often a regulatory agency or independent testing lab will require specific tests on completed products immediately prior to packaging for shipment. The products must pass these tests as a condition for "listing" or "recognition" or "certification" or even for permission to offer the product for sale.

III. Acceptance Tests: A purchaser may conduct tests on purchased components to prove that they meet minimum insulation specifications, to prevent faulty components from being incorporated into his own products.

IV. Service or Maintenance Tests: The owner of a piece of equipment may wish to periodically verify the integrity of its insulation system, to determine whether or not deterioration has taken place, and to what extent. A rebuilder of motors, etc., may wish to verify that his work was done properly by performing tests on the rebuilt equipment. A repairer of appliances, entertainment devices, etc., may wish to verify that he has not degraded the insulation system of any item he has repaired and to give the owner some minimum assurance of safety.

TYPICAL APPLICATIONS

To insure that the insulation or insulation system is properly stressed during a dielectric withstand test, the voltage must be applied across the insulation. This would not be the same connection as is normally used to power up the device being tested. For each of the categories of items mentioned earlier, we will discuss the usual application of the test potential:

I. Insulating raw materials: In general, the test voltage is applied to the test sample by placing the sample between two metallic electrodes connected to the Hypot® output. Of course, the size and shape of the electrodes must be proper for the type and amount of material being tested, and for testing liquids or gases, suitable containers must also be used.

II. Components: Most often the tests required for components test the insulation between parts which are normally conducting and parts which are normally isolated and non-conducting or grounded. For example, in testing a potentiometer, the three potentiometer terminals would normally be shorted together and connected to the high voltage lead, and the case of the potentiometer would be connected to the ground lead. Sometimes, as in the case of transformers and motors, additional tests are required between normally conducting parts which must be kept insulated from each other. A simple transformer, for example, would receive three tests: primary to frame, secondary to frame, and primary to secondary. When testing transformers, it is common and recommended practice to tie both ends of a winding together before applying one side of the high voltage. It is not the continuity of the winding which is being tested, but the insulation

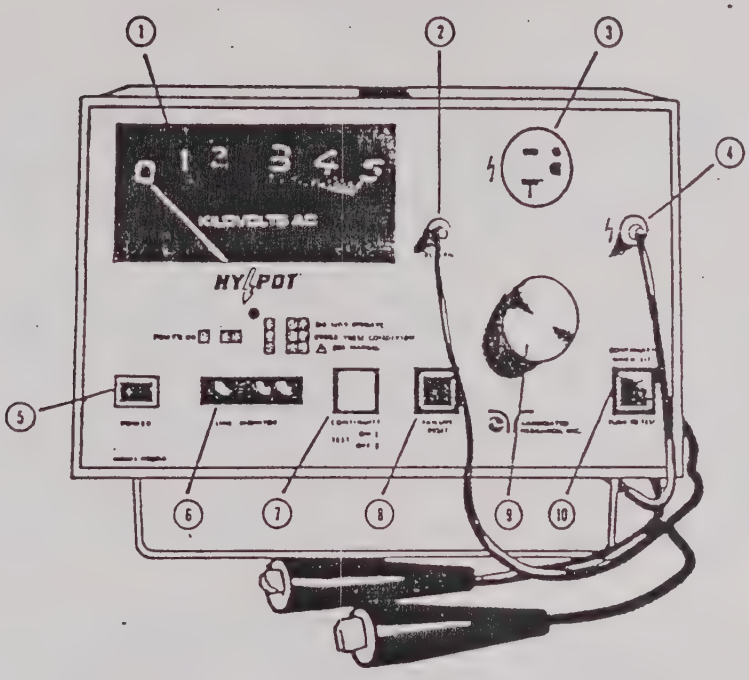
from every part of the winding to other components of the transformer. Similar treatment is usually given any winding, coil or heating element in a component, because over-voltaging these parts is not generally part of the Hypot® test. Switches and relays, in addition to being tested from conducting parts to dead parts, are often also tested across open contacts. A special electrode may be required to test resistors, capacitors and similar items when it is desired to test the insulation provided by a coating or molded case. The special electrode, touching the outside of the case, is one connection point. The other is the leads of the device, all shorted together.

III. End products: These are typically cord-connected finished products. The double-insulated variety must be tested with special electrodes touching the outside of the case connected to one side of the Hypot® and both blades of the line cord connected together and to the other side of the Hypot®. Any device with metal parts on its exterior should have the return (ground) lead connected to those metal parts (all connected together at once, or sequentially) and the high voltage applied to both blades of the line cord shorted together. The receptacle on the Hypot® is a convenient way to connect the line and neutral terminals of the line cord together and to the high voltage. In addition, the third (grounding) conductor of a three-wire line cord can be tested for continuity before the high voltage is applied. For any testing of cord-connected end products, always leave the power switch(es) on so that the entire line circuit will be tested. If the device does not have a neutral connection, and the ground connection normally carries current, it will fail a Hypot® test from line to ground unless the connection from the internal wiring to ground is temporarily lifted during the test. Combination 240-120V appliances are often of this nature.

IV. Repaired or rebuilt products: The same techniques are generally used as on new equipment, except that the test voltage or time is sometimes reduced.

The voltage used and the time for which it is applied are sometimes specified by the manufacturer of an insulating material or by a regulatory or testing agency. When they are not, the following "rule of thumb" is often used: determine the voltage(s) in the circuit(s) being tested, under normal operating conditions. For a circuit to circuit test, as in a transformer, the voltage will depend on the degree of isolation required between circuits. For a circuit to ground or circuit to dead metal test, use two times the normal voltage plus 1000V. For example, a household iron rated at 120V would normally be tested at 1240V.

FEATURES OF MODEL 4050A



1. Wide, easy reading 4-1/2 inch kilovoltmeter with 2% of full scale accuracy.

2. Detachable 5 foot return (ground) lead. This lead is always used in making a test. It is grounded for safety during the test. When testing a device with a three-wire cord, this lead may remain grounded as the third pin of the line cord is momentarily lifted from ground to perform the continuity test. Unlike other testers, it is possible to perform a reliable ground continuity test on a device which is grounded in its installation, such as a submersed pump or under-sink waste disposer.

3. Receptacle for testing cord-connected devices. The line and neutral terminals of this receptacle are connected together and to the high voltage output. The ground terminal is isolated from ground during continuity tests, and connected to ground during Hypot® tests.

4. Detachable 5 foot high voltage lead for testing non-cord-connected devices. Flexible silicone rubber insulation for easy handling. Jack well recessed for safety when this lead is not used.

5. Rocker power switch with international on and off markings.

6. Line safety monitor shows the condition of the power receptacle to which the Hypot® is connected. Proper grounding is essential for

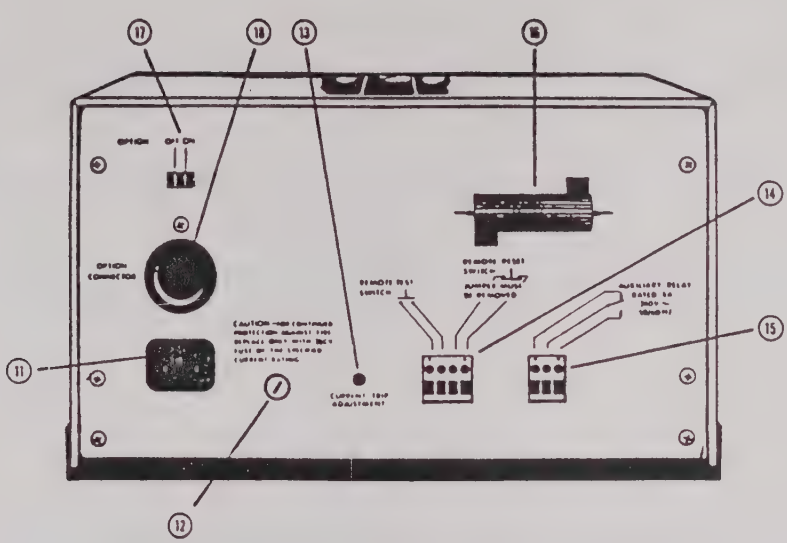
safety while performing Hypot® tests. Therefore, the Hypot® must not be used unless its power receptacle is properly grounded. The line monitor should be checked every time the Hypot® is turned on. It should indicate a safe power on condition. Any other indication represents a dangerous condition and the Hypot® must not be used until the trouble is corrected.

7. Continuity Test On-Off Switch. When testing devices with three-wire cords, this switch should be in its IN position (illuminated). First connect the return lead to the exposed metal of the device. Then, as the line cord is plugged into the high voltage receptacle, the continuity light in the Push to Test switch should illuminate, indicating that there is continuity from the ground pin of the plug to the exposed metal. If this does not happen, there is no continuity, and it will not be possible to apply the high voltage. When testing other types of items, this switch should be in its OUT position (not illuminated).

8. Failure indicator and Reset switch. If excessive current is drawn during the Hypot® test, the high voltage will shut down, and the red Failure indicator will illuminate along with the audio alarm sounding. To reset the system to allow further testing, it is necessary to press the Reset switch and release it.

9. Voltage adjust knob. This control varies the high voltage from near zero to the full 5000 volts. The voltage can be adjusted only when the Push to Test switch is depressed. Therefore, if the setting is unknown, either check it with the test leads disconnected or return it to zero before pressing the Push to Test switch. Some types of testing require gradual application of the test voltage. In those cases, it is possible to press the Push to Test button and increase the voltage with one hand. Other types allow presetting the voltage. In those cases the setting may be left undisturbed and when the Push to Test switch is pressed, the entire voltage will be applied. The voltage should be monitored by observing the meter as line voltage or tested load fluctuations will cause it to vary.

10. Continuity indicator and Push to Test switch. When testing devices with three-wire line cords, this lamp indicates whether or not there is continuity between the ground pin and the exposed metal on the device. If there is no continuity, pressing the Push to Test switch will not apply the high voltage. When there is continuity, or when other than three-wire cord-connected devices are being tested, the Push to Test switch activates the high voltage output of the Hypot®.



11. Detachable 7-1/2 foot power cord with standard connector.

12. Line fuse accessable from the rear. "Shock safe" fuseholder.

13. Current Trip (sensitivity) adjustment. The current at which the failure alarm will trip is adjustable from approximately .75 mA to 25 mA. Turn the control counterclockwise to decrease the current setting and increase sensitivity. Turn it clockwise to increase the current setting and decrease sensitivity.

14. Remote switch connections. Terminals are provided to connect a remote Push to Test switch and a remote Reset switch. The Push to Test switch must be a momentary contact Normally Open switch. It could take the form of a foot switch, or relay contacts in an automatic test system. The Reset switch must be a momentary contact Normally Closed switch. THE JUMPER MUST BE REMOVED FROM THE TERMINALS WHEN THE REMOTE SWITCH IS CONNECTED, AND REPLACED WHEN THE REMOTE SWITCH IS DISCONNECTED. This switch also could be a foot switch, or a set of relay contacts in an automatic test system.

15. Auxiliary Relay connections. The auxiliary relay actuates simultaneously with the Failure indicator and audio alarm. It is reset by the Reset switch. SPDT contacts are brought to the terminal strip for connection to an automatic reject device or automatic test system, or to an audible or visual failure indicator which is either remote or is more apparent than the built-in indicators. The contacts are rated at least 5 A, 240 VAC, 50/60 Hz.

16. OPTIONAL Calibration Resistor. A 120K ohm 1% resistor used to calibrate or check the sensitivity setting when this value is specified to be used.

17. Option off-on switch. Used to disable or enable an option which is connected to the option connector.

18. Option connector. Various options, such as a dwell timer, ramp and dwell, auto-reset, or automatic test sequencer, may be connected here.

OPERATING INSTRUCTIONS

1. Locate the Hypot® in a suitable location for performing tests. There should be adequate light and power available. Allow sufficient room for the devices to be tested in such a way that the connections to them will be straightforward and uncrowded and all personnel will be able to stay clear during the tests. The table or bench should be nonconducting. If a conductive surface must be used, it should be securely grounded to a good earth ground, and the high voltage connection will need to be properly insulated from ground.

2. Be sure the power switch is off. Install and connect the line cord. Connect the return lead to the Hypot® and to the item to be tested. If it is to be used, connect the high voltage lead to the Hypot® and to the item to be tested. If a cord-connected device is to be tested, plug it into the high voltage receptacle and set the Continuity Test ON-OFF switch to ON for a three-wire cord or OFF for a two-wire cord.

3. Turn the Power switch on. Observe the Line Monitor. If it indicates Power On (OFF-ON-ON), the power receptacle is wired properly. For any other indication, turn the Hypot® off, disconnect it, and do not use it at that location until the problem is corrected.

4. Do not touch the device under test. Rotate the voltage control fully counterclockwise. Press and hold the Push to Test switch and rotate the voltage control until the desired voltage is reached. Hold the switch until the desired test time has elapsed, starting timing when the proper voltage is reached. Then release the switch. If there has not been any failure indication, the item has passed the test.

5. Verify that the high voltage has dropped to zero by observing the meter. The item tested can then be disconnected and the next item connected for testing. If the test voltage can be applied all at once, then the voltage control setting can be left alone and testing is accomplished by pressing and holding the Push to Test switch while monitoring the voltage on the meter. If the voltage must be applied gradually, step #4 must be repeated.

LINE MONITOR "DO NOT OPERATE" CONDITIONS

One of the "Do not operate" conditions of the line monitor on the front panel will appear whenever a combination of improper or missing connections occurs in the input line to the Hypot® tester.

The following shows the various combinations of lights and explains what causes them:

|_| |X| |_| Open ground (ground wire is not connected to Hypot®.)

|X| |_| |X| Do not touch the tester!
Indicates one of the following:

1. Open neutral.
2. Reversed polarity hot open (hot applied to neutral and either no connection to hot terminal or power switch off).
3. Hot and ground reversed
   Note: That this combination will be seen whether the power switch is on or off.

|X| |X| |_| Reversed polarity

CURRENT TRIP (SENSITIVITY) ADJUSTMENT

The failure detector has been preset so that at 5 mA or more the alarm will sound. If this setting is not appropriate for the intended application, it can be reset as follows:

1. Two resistors are recommended for use in adjusting the sensitivity. Rb may be called out in the testing requirements, or may be calculated as follows:

$$\frac{\text{Voltage at which the test is being made}}{\text{Minimum current which must trigger failure}} = Rb$$

After the sensitivity is properly adjusted, resistor Rb must always fail. Rb should be a single resistor or a combination of resistors as close to the calculated value as possible, with a tolerance of 1% or better. Rg is chosen to be approximately 5% more than Rb (1.05 times Rb). The closest standard value should be used. There is no need for the value of Rg to be very precise. If a looser tolerance resistor (more than 2%) is used for Rg, an ohmmeter should be used to verify that Rg is indeed approximately 5% higher than Rb. After the sensitivity is properly adjusted, resistor Rg must always pass. Both Rb and Rg should be rated to handle the power they will be dissipating (Test voltage squared/Rb).

2. The voltage should be set using Rg. This will produce the maximum load on the Hypot®. The voltage decreases somewhat with load, so when testing a good unit or with no load, the voltage will be more than what is specified. However, in no case should it rise by more than 20%.

3. When Rb is tested, the alarm should sound. It may not begin immediately, but it should start within .5 seconds after the voltage reaches the vicinity of the specified test voltage. If the alarm does not sound, adjust the current trip control a small amount counterclockwise and repeat the test. If the alarm sounds when Rg is tested, adjust the control a little clockwise and repeat the test. Holding the Push to Test button while adjusting the control does not produce acceptable results.

4. When the setting is close to being correct, recheck the voltage setting using Rg. There is some interaction between the sensitivity setting and the voltage control. If it is desired, the voltage can be set somewhat higher than the specified test voltage, to account for line voltage fluctuations during the day. Recheck with no load to be sure that the voltage does not exceed 120% of the specified test voltage.

5. The sensitivity setting must be fine tuned so that Rg always passes

and Rb always fails. Wait approximately ten seconds between successive tests when testing manually. This will allow the neon lamp-photocell failure detector to recover and it will take less time to achieve repeatability.

6. When doing automatic testing, the tests should always be done at the normal speed. This should ensure consistent timing between tests, and approximate normal operation. Prepare a mix of marginally good units containing a resistance of value Rg instead of their normal contents, and marginally bad units containing a resistance of Rb instead of their normal contents. Mark them clearly GOOD and BAD. If all good units pass, and some bad units pass, adjust slightly counterclockwise and run the samples through again. If all bad units fail and some good units fail, adjust slightly clockwise and run the samples through again. If some good units fail and some bad units pass, check the difference in resistance between the two types. It could be that the system cannot distinguish a small differential. If the differential is 5% or more and repeatability still cannot be obtained, it could be that the failure detector cannot keep up with the speed of the equipment. Try it at a lower speed if possible.

7. Retain the set of marginally good and marginally bad units, or resistors Rb and Rg, in order to check and readjust the sensitivity setting at a later date. A schedule should be set up to do this periodically.

MODEL 4050A SPECIFICATIONS

MODEL:	4050A
DESCRIPTION:	AC Hypot® and ground continuity test set.
PRIMARY APPLICATION:	Manufacturing and production line testing of commercial and consumer products to meet UL, CSA, VDE, BSI, and IEC requirements where dielectric withstand and ground continuity tests are specified.
INPUT:	120 volts AC, 50/60 Hz., single phase, 1.5 amp.
HYPOT OUTPUT:	0-5 kV AC continuously adjustable, frequency 50/60 Hz, current 25mA.
FAILURE DETECTOR:	Audible and visual means of indicating an unacceptable performance in addition to auxiliary relay contacts (SPDT) transferred when failure is detected. Failure detection system remains activated until manually reset. This is accomplished through a current sensitive overload system monitoring current in the return side of the output and an RF detector which responds to breakdown or arcing condition. Adjustable current sensitivity from .75 to 25 mA. The failure detector is factory set at 5 mA. The failure detector setting may be easily reset if desired.
METERING:	Kilovoltmeter analog 0-5 kV with 100 volt reading resolution connected directly across the output terminations. Accuracy 2% of full scale. Tracking 2% of full scale.
TERMINATIONS:	Detachable input power cable 7-1/2 foot three conductor terminated in a three prong grounding type plug.
HIGH VOLTAGE & RETURN/CONTINUITY:	High voltage three prong isolated grounding type receptacle allows equipment to be tested to be plugged directly into the dielectric withstand tester. Also equipped with removable five foot high voltage and return/continuity leads.
CONTINUITY TEST:	Ground continuity test between grounding conductor and exposed dead metal parts performed automatically regardless if equipment to be tested is grounded or not by some other means, while making connections for Hypot test. Ground

continuity indicated by glow of the lamp in the Push to Test switch, should there be no continuity high voltage cannot be applied. Hypot test may be performed on items which do not require the ground continuity test by not activating the ground continuity test switch.

REMOTE CONTROL: Terminals are provided for connections of remote start and reset switches.

Auxiliary relay contacts (SPDT) rated for 240 volts at 5 amps transferred when failure is detected.

OPTIONAL CALIBRATION RESISTOR: 120 k ohm 1% resistor located on the rear panel is provided for the user to set sensitivity of the failure detector in accordance with UL specifications.

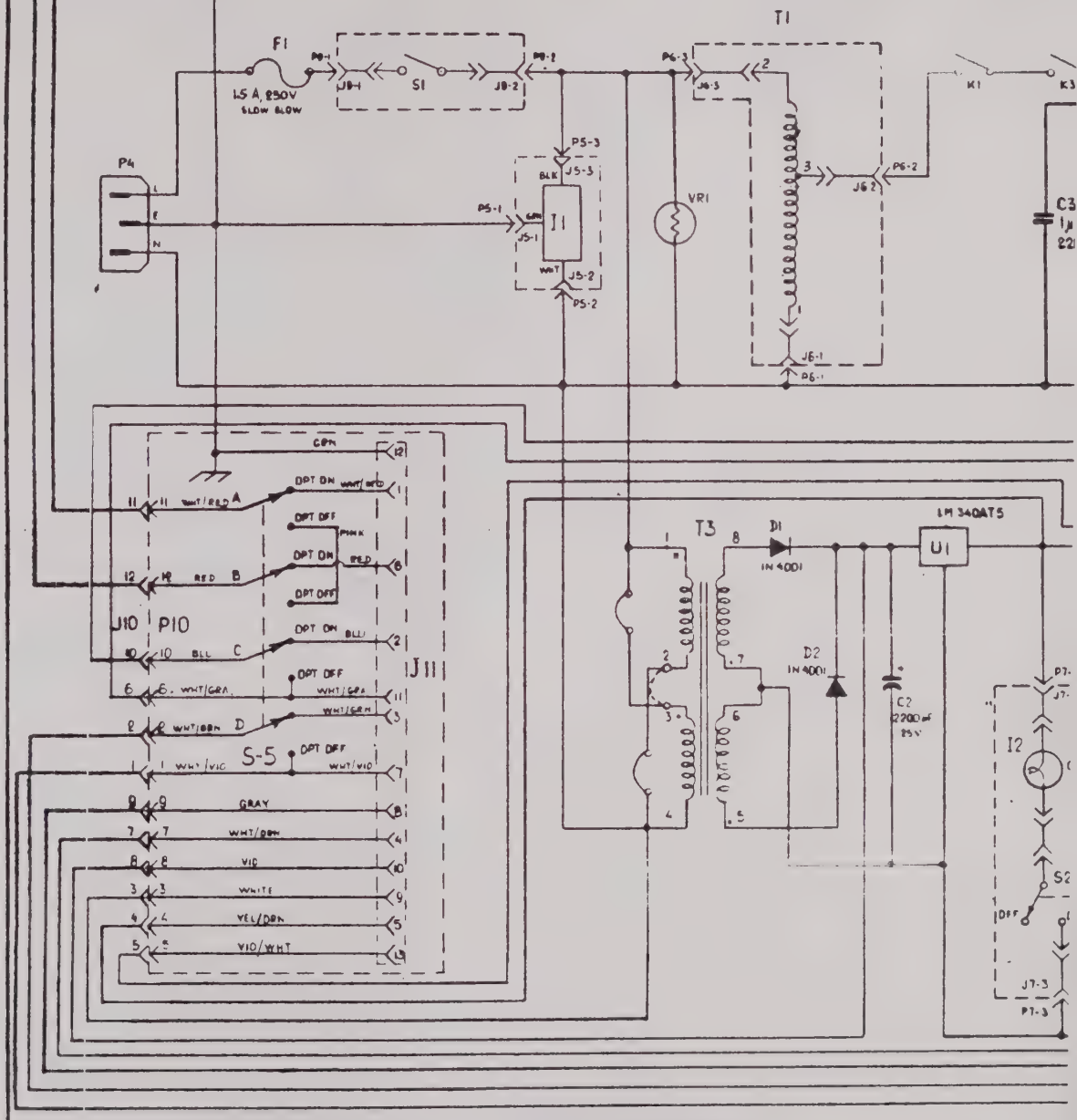
OPTION CONNECTOR: Various options, such as a dwell timer, ramp and dwell timer, auto-reset, or IEEE-488 interface, may be connected here.

LINE SAFETY MONITOR: A safe power-on indicator monitors input power and warns against malfunctions in the grounded 3-wire 120 volt AC receptacle to which the equipment is connected.

CABINETRY: Portable with recessed handle and tiltstand 11" x 11" x 6.6 (279.4 x 279.4 x 167.64 MM)

WEIGHT: Approximately 14-1/2 lbs. (6.58 kilograms.)

SYM	DESC
D	ADDED VR8;
E	R7 WAS 27K



OPTIONAL CALIBRATION RESISTOR

R6 120K 50W 1%

REMOTE SWITCH CONNECTIONS

TS-1

1 ∅
2 ∅ REMOTE TEST SWITCH CONNECTIONS

3 ∅
4 ∅ REMOTE RESET SWITCH CONNECTIONS (REMOVE JUMPER)

AUXILARY RELAY C

TS-2

N.C. ∅
COM ∅
N.O ∅

J12 AND J13 ARE REAR OUTPUTS USED ON MODEL 4050 AR ONLY

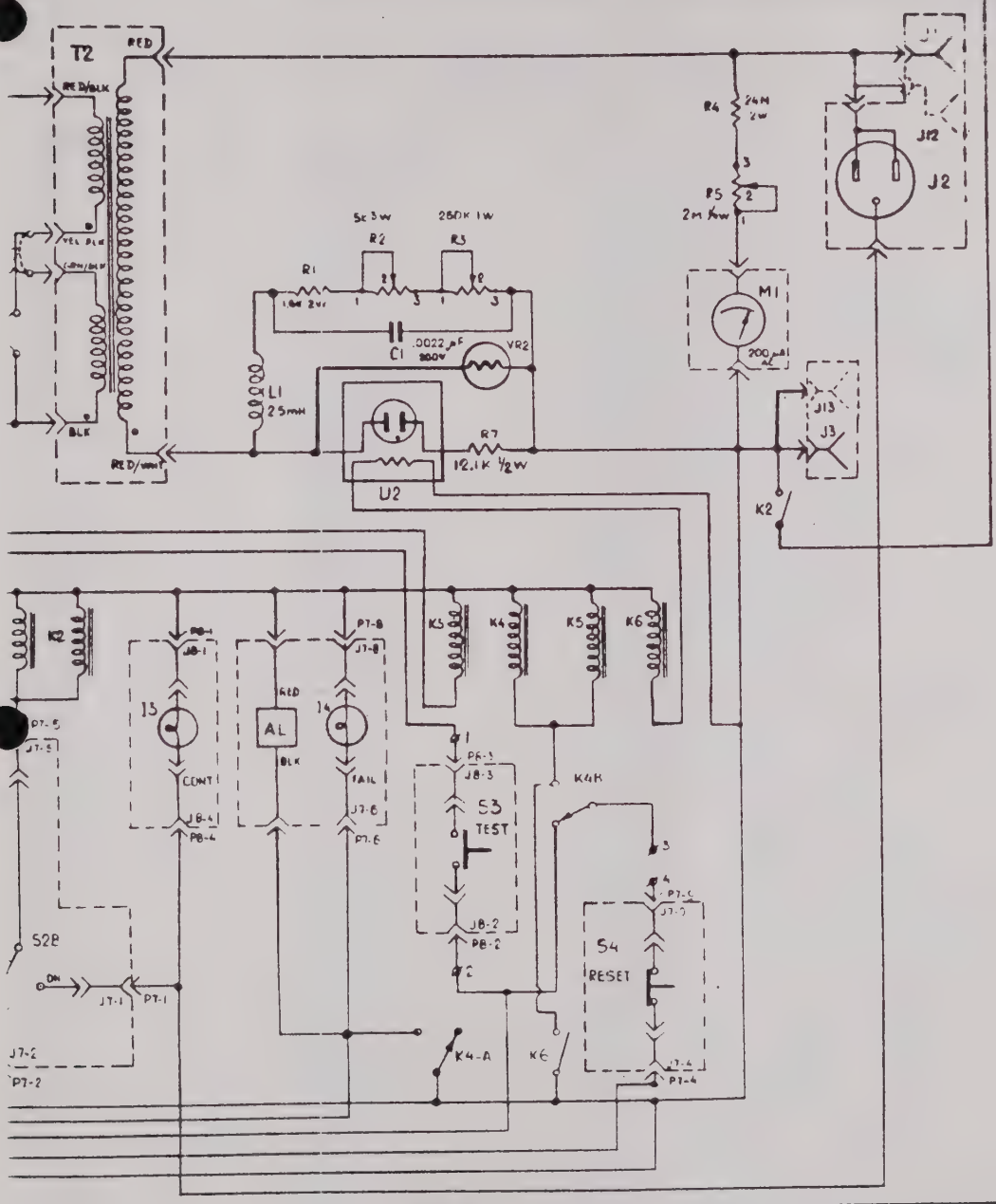
NOTES SPECIFIC
INSTALL THE JUMPERS SHOWN BY SOLID LINE (4PLCS)
DO NOT INSTALL THE JUMPERS SHOWN BY BROKEN LINE (2PLCS)
ALL PARTS ARE ON THE PC BOARD EXCEPT THOSE ENCLOSED WITH BROKEN LINES

1 REMOVE ALL BURRS AND SHARP EDGES NICKS AND SCRATCHES
NOTES GENERAL UNLESS OTHERWISE SPECIFIED AND AS APPLICABLE

ON	ECO	DATE	APPR	CHK
3	E/F	2-28-85	DD	JL
		4-17-85	DD	JL

REVISIONS						
SYM	DESCRIPTION	ECO #	DATE	APPR	CHK
A	REVISED SMB. SHEET 2		6-17-84	K	DD
B	ADDED J12 AND J13 PROVISION	B	7-12-84	K	JBL
C	REVISED OVERLOAD CKT. WIRING		8-29-84	K	DD

REV. STATUS OF SHEETS	
SHT.	REV.
1	E
2	
3	
4	
5	



ITEM #	QTY REQD	PART NUMBER	DESCRIPTION OR NOMENCLATURE	NOTE
MATERIALS OR PARTS LIST				

PROPRIETARY DATA

ASSOCIATED RESEARCH, INC.

O LICENSE IS GRANTED TO PUBLISH, PLICATE OR OTHERWISE DISCLOSE HIS DATA TO ANY OTHER ORGANIZA-ION, AGENCY OR COMPANY FOR ANY URPOSE WHAT SO EVER

UNLESS OTHERWISE SPECIFIED DIMENSIONS ARE IN INCHES TOLERANCES

FRACTIONAL ± 1/64 | ANGLES ± 1° | SURF FINISH N/A ✓

HEAT TREAT | FINISH

SYMBOLS ▷NOTES ☐PARTS LIST ITEM NUMBER

USED ON MODEL/ ASSY: 4050 A S/N 210 & UP

NEXT ASSY NUMBER

DRAWN	G. L.	3 19 84
CHECKED	T M D	3 20 84
APPROVED	A	3-20 84

ASSOCIATED RESEARCH, INC.

HYPOT. 5KV, 25mA

SCHEMATIC WIRING DIAGRAM

SIZE C | S04050A

SCALE / NTS | WT

REPLACEMENT PARTS LIST

SYMBOL	PART NUMBER	D E S C R I P T I O N S	QTY
AL	35520	Piezo-Alarm	1
C-1	35497	Capacitor 0.0022 uF 200V 10%	1
C-2	35216	Capacitor, 2200 uF, 25V	1
C-3	35825	Capacitor, 1 MFD., 220V AC Film	1
D-1, D-2	35214	Diode, 50 VRMS, in 4001, Low Volt	2
F-1	17756	Fuse, 1.5A, 250V, Slow Blow	1
I-1,	04040A-19	Indicator, Line Monitor Assy.	1
J-1	04040A-18	Jack Female H. V.	1
J-2	04040A-17	Receptacle Connector, Female	1
I-2,3,4	35467	Lamp, Incandescent 6.3V	3
J-3	15495	Jack Banana, Insulated, Black	1
J-10	35531	Header Socket, 12 Pos.	1
K-1,5	35432	Relay, 5 V. SPDT, 5A	2
K-2	35433	Relay, 5V, SPDT,DIP	1
K-3	35826	Relay, Solid State, 240V AC, 3A.	1
K-4	35434	Relay, 5V, DPDT, DIP	1
K-6	35435	Relay, 5V, SPST SIP Reed	1
L-1	11155	Choke, HF 2.5 mH	1
M-1	35619	Meter, 0-200 mA AC, Scale 0-5 kV	1
P-4	35492	Receptable, 250 VAC, 6A, Male	1
P-5,6	35473	Connector, Male, 3 Pos.	2
P-7	35477	Connector, Male, 9 Pos.	1
P-8	35475	Connector, Male, 4 Pos.	1
P-9	35470	Connector, Male, 2 Pos.	1
R-1	35448	Resistor, Fixed, 1.6 K Ohm, 2W, 5%	1
R-2	35494	Resistor, Var. 5 K ohm, 3W, 20%	1
R-3	35824	Resistor, Var. 250K, 1W, 10%	1
R-4	35667	Resistor, Fixed, 24 M ohm, 2W, 1%	1
R-5	35496	Resistor, Var., 2 M ohm, 1/4W, 1%	1
R-7	34878	Resistor, Fixed, 12.1K ohm, 1/2W, 1%	1
S-1	35440	Switch SPST, Rocker	1
S-2	35450	Switch, Push Button DPDT Alt	1
S-3,4	35449	Switch, Push Button, SPDT Moment	2
	35452	Lens, Yellow SQ.	1
	35453	Lens, Light Green for S3	1
	35451	Lens, Red for S4	1
T-1	35441	Transformer, Variable	1
T-2	35668	Transformer, HV. 5000V, 25mA	1
T-3	35454	Transformer, Stepdown	1
TS-2	35443	Terminal Strip 3 Pole	1
TS-1	35444	Terminal Strip 4 Pole	1
U-1	34935	IC, Voltage Regulator LM340AT5	1
U-2	35505	OPtoisolator, Neon, Photocell	1
VR-1	19840	Varistor, Disk, Red 130V	1
VR-2	35823	Varistor, 130V, 20 MM	1

REPLACEMENT PARTS LIST - Cont'd

SYMBOL	PART NUMBER	D E S C R I P T I O N	QTY
	35458	Fuseholder, PCB Mounted	1
	35457	Fuse Carrier for 1/4 x 1-1/4 inch Fuse	1
	35464	Heat Sink for U1	1
	35498	Tab, .110 Faston PCB Mounting	2
	35499	Tab, Single .187 Faston PCB Mounting	6
	35500	Tab, Double .187 Faston PCB Mounting	3
	33189	Line Cord	1
	35436	Knob, Voltage Adjust	1
	04040A-08	High Voltage Cable Assy.	1
	04040A-09	Return Cable Assy.	1
	04040A-10	Harness Assy. for S-3	1
	04040A-11	Harness Assy. for S-2,4	1
	04040A-12	Jumper Wire Assy. for Meter	2
	04040A-13	Harness Assy. for T-1	1
	04040A-14	Harness Assy. for S-1	1
	04040A-23	Option Connector Assembly Incl. Switch	1 (S5)

LIMITED WARRANTY

This new instrument is warranteed to be free from defects in workmanship and material for one year from the date of shipment, provided the Owner's Registration Card is returned within fifteen (15) days from receipt of the unit and there is no evidence of modifications, tampering or physical damage. Elimination of any connections in the earth grounding system or by-passing any safety systems will void this warranty.

THIS WARRANTY DOES NOT COVER TUBES, BATTERIES OR ACCESSORIES NOT OF ASSOCIATED RESEARCH MANUFACTURE.

Any unit found defective under this warranty will be repaired free of charge if returned to the factory prepaid and insured.

EXCEPT AS PROVIDED HEREIN, ASSOCIATED RESEARCH MAKES NO WARRANTIES TO THE PURCHASER OF THIS UNIT AND ALL OTHER WARRANTIES, EXPRESS OR IMPLIED (INCLUDING, WITHOUT LIMITATION, MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE) ARE HEREBY EXCLUDED, DISCLAIMED AND WAIVED.

To avoid delay, before returning the instrument for repair, you must first contact Associated Research for authorization and shipping instructions.

OUR PRODUCTS & SERVICES INCLUDE:

Meg-Chek®	Insulation Resistance Testers
Vibroground®	Ground Resistivity Testers
Hypot®	AC & DC High Potential Testers
Hyjoule®	Primary & Secondary Fault Locators & Tracers
ARUsm	Cable Testing/Fault Locating School
	Ground Resistance Testing School

ASSOCIATED RESEARCH, INC.
8221 NORTH KIMBALL AVENUE
SKOKIE, ILLINOIS 60076
U.S.A.

continuity indicated, by glow of the lamp in the Push to Test Switch, should there be no continuity high voltage cannot be applied, the Failure lamp will glow and the Alarm will sound when the Push To Test Switch is activated. Hypot test may be performed on items which do not require the ground continuity test by not activating the ground continuity test switch.

REMOTE CONTROL: Terminals are provided for connections of remote start and reset switches.

Auxiliary relay contacts (SPDT) rated for 240 volts at 5 amps transferred when failure is detected.

OPTIONAL CALIBRATION RESISTOR: 120 k ohm 1% resistor located on the rear panel is provided for the user to set sensitivity of the failure detector in accordance with UL specifications.

OPTION CONNECTOR: Various options, such as a dwell timer, ramp and dwell timer, auto-reset, or IEEE-488 interface, may be connected here.

LINE SAFETY MONITOR: A safe power-on indicator monitors input power and warns against malfunctions in the grounded 3-wire 120 volt AC receptacle to which the equipment is connected.

CABINETRY: Portable with recessed handle and tiltstand 11" x 11" x 6.6 (279.4 x 279.4 x 167.64 MM)

WEIGHT: Approximately 14-1/2 lbs. (6.58 kilograms.)

DUO-TANG
52258
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